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Research Memorandum 4

Accuracy of MI Rifle Scores Obtained on the Known-Distance Range

by

F. J. McGuigan and Victor H. Denenberg

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The George Washington University
HUMAN RESOURCES RESEARCH OFFICE
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ACCURACY OF M1 RIFLE SCORES OBTAINED ON THE KNOWN-DISTANCE RANGE

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Problem

If the M1 rifle marksmanship scores made by trainees on the known-distance range are to be used as criteria for training experiments in small arms, it is essential that the scores be accurately recorded. The easiest method of obtaining the trainees' marksmanship scores is to copy them directly from the rifle score card filled out on the firing line by the coach or the firer himself. However, scores recorded by this method appeared to be highly susceptible to various errors, such as those that occur in the transmission of information from the pits to the firing line,[1] or that result from any tendency of the firer to report a score different from that actually received.

Because of this probability of error in the customary firing line scoring, in several training experiments special pit crews were used to obtain the firer's score directly in the pits where an accurate record was assured. Although pit scoring involves considerable extra effort, such as obtaining and training additional range personnel, coordinating the firer's pit score card with his firing line target and order number, and planning transportation and rations for the pit crews, this extra effort appeared justified in order to ensure the accuracy of the marksmanship scores to be used in the experiments.

This Research Memorandum presents data on the following points:

(1) Discrepancies between scores as recorded in the pits and on the firing line.

(2) The effect, on firing line scoring errors, of informing trainees that they were also being pit scored.

[1] A trainee's score is transmitted to the firing line by means of a marker which a pit man holds over the bullet hole. Different markers are used to designate the different score values. Scoring errors occur when the pit men use the wrong marker or fail to find the bullet hole, and when the firer misreads the correct marker.

(3) Marksmanship "qualification" scores on the known-distance range as recorded in the pits, and a comparison of these scores with firing line "qualification" scores.

The data reported in this Memorandum were obtained in conjunction with several other research tasks carried out by Field Unit No. 1.[2,3] They were brought together into a single report because of the importance of the findings for research planning, as well as their implications for Army training operations.

Procedure

In the course of four experiments conducted at two training installations, both pit and line scores for the M1 rifle record course were obtained for six different companies, and pit scores only were gathered for four additional companies. Of the six companies scored both in the pits and on the line, two were informed that they were being pit scored, and the other four were not given this information. The pit score cards were identified by maintaining a firing line roster of trainees' target and firing order numbers. Cadre and instructors were not allowed to assist the trainees except for zeroing the rifles and for ensuring proper safety measures. "Alibi runs" after sustained fire exercises were restricted to malfunctions of weapons.

Results

Pit scores and line scores were compared for four companies firing for record on the known-distance range. Only two of the companies had been told that they were being scored in the pits. Although it cannot be said with certainty that the other two companies were unaware that they were being pit scored, probably the dissemination of this information was limited. To compare the discrepancies between pit and line scores for both informed and

[2]McGuigan, F. J., "A Comparison of the Whole and Part Methods of Marksmanship Training" (Information Report), AFF Human Research Unit No. 1, Fort Knox, Kentucky, under technical supervision of Human Resources Research Office, The George Washington University, Washington, D. C., July 1953.

[3]Denenberg, V. H. and McGuigan, F. J., "Evaluation of a Special Live-Firing Trigger-Squeeze Exercise," final report in preparation. Information Report as rendered to Office, Chief of Army Field Forces, available at Human Research Unit No. 1, OCAFF, at Fort Knox, Kentucky.

uninformed companies, the pit scores were subtracted from the firing line scores, and these differences were grouped into intervals of 15 points. Figure 1 and Table 1 show the percentage of trainees falling into each 15-point interval, and Figure 2 shows the percentage of trainees whose line scores were greater than, the same as, or less than their pit scores.

The distribution of the total record firing scores made by the trainees on the known-distance range on the basis of pit scoring is shown in Figures 3 and 4. The records of four companies at one Army installation are graphed in Figure 3, and a corresponding distribution for four companies firing a different course at another installation is shown in Figure 4.

The percentage of trainees who would qualify for the various Army marksmanship ratings[4] on the basis of the pit scores made in this experiment also was calculated. Figures 3 and 4 show the distribution of actual pit scores as compared with the scores required for the various ratings. Figure 5 shows the percentage of men falling within each marksmanship bracket on the basis of pit scores, calculated from the records of 1878 men comprising 10 companies (five at each of the two installations at which data were collected). For purposes of comparison, Figure 5 also includes percentages for men who qualify for the various marksmanship ratings on the basis of firing line scores; these data were computed from the two "uninformed" companies shown in Figure 1.[5]

Interpretation

It is apparent, from Figures 1, 2, and 5, that considerable error is introduced in recording the scores from the firing line. This error is decidedly in the direction of increasing the firing line scores, as can be seen from the extended gradients to the right in Figure 1, as contrasted with the abbreviated gradients on the left. It also appears that this error was sharply reduced, but not

[4]Expert, Sharpshooter, and Marksman; the scoring requirements under which trainees qualify for the various ratings are set by the course they fire and the number of rounds of ammunition fired. The two Army installations differed both in the type of courses used and the number of rounds fired.

[5]The N for the "uninformed" companies in Figure 5 is greater than the N for the same companies in Figure 1 because for a number of the trainees line scores were available but pit scores were not. Figure 5 is based upon the line scores of all the trainees in the two companies, regardless of whether they had a pit score.

eliminated, by informing the trainees that they were also being scored in the pits. Thus, while about 60 per cent of the firing line scores for the "informed" companies agreed with their pit scores, only about 20 per cent of the firing line and the pit scores for the "uninformed" companies were in substantial agreement (i.e., within $\pm$ 7 points of each other). The maximum discrepancy between pit and line scores in the "informed" companies was +60 points, whereas the maximum discrepancy within the "uninformed" companies was +165 points.

Examination of the pit score data shown in Figures 3, 4, and 5 indicates that the majority of trainees do not actually qualify on the M1 record course. The fact that this finding appears consistently in so many companies, sampled at separate training installations, strengthens belief in its reliability. It strongly indicates the need for further research concerning methods which would bring marksmanship proficiency up to the desired standards. However, the practical limitations of the current Army Training Program should be recognized in studying the problem. For example, no selectivity is possible because all trainees are expected to fire for the record; the time available for rifle instruction, including the record firing, totals only 66 hours, about half of which is spent away from the firing line. Research must be continued to determine what training modifications will result in a significant improvement in marksmanship.

Conclusions

(1) Errors introduced in firing line scores are sufficient to make such scores unusable for research purposes.

(2) Errors in firing line scores are reduced by informing the trainees that they are being pit scored.

(3) Pit scores on the known-distance range indicate that marksmanship proficiency is considerably lower than that called for by current Army standards.

(4) These findings accentuate the need for a continuing program of research within the area of marksmanship training.

DISTRIBUTION OF DISCREPANCIES BETWEEN PIT AND LINE SCORES FOR M1 RECORD FIRING

(Informed and Uninformed Companies, Known-Distance Range)

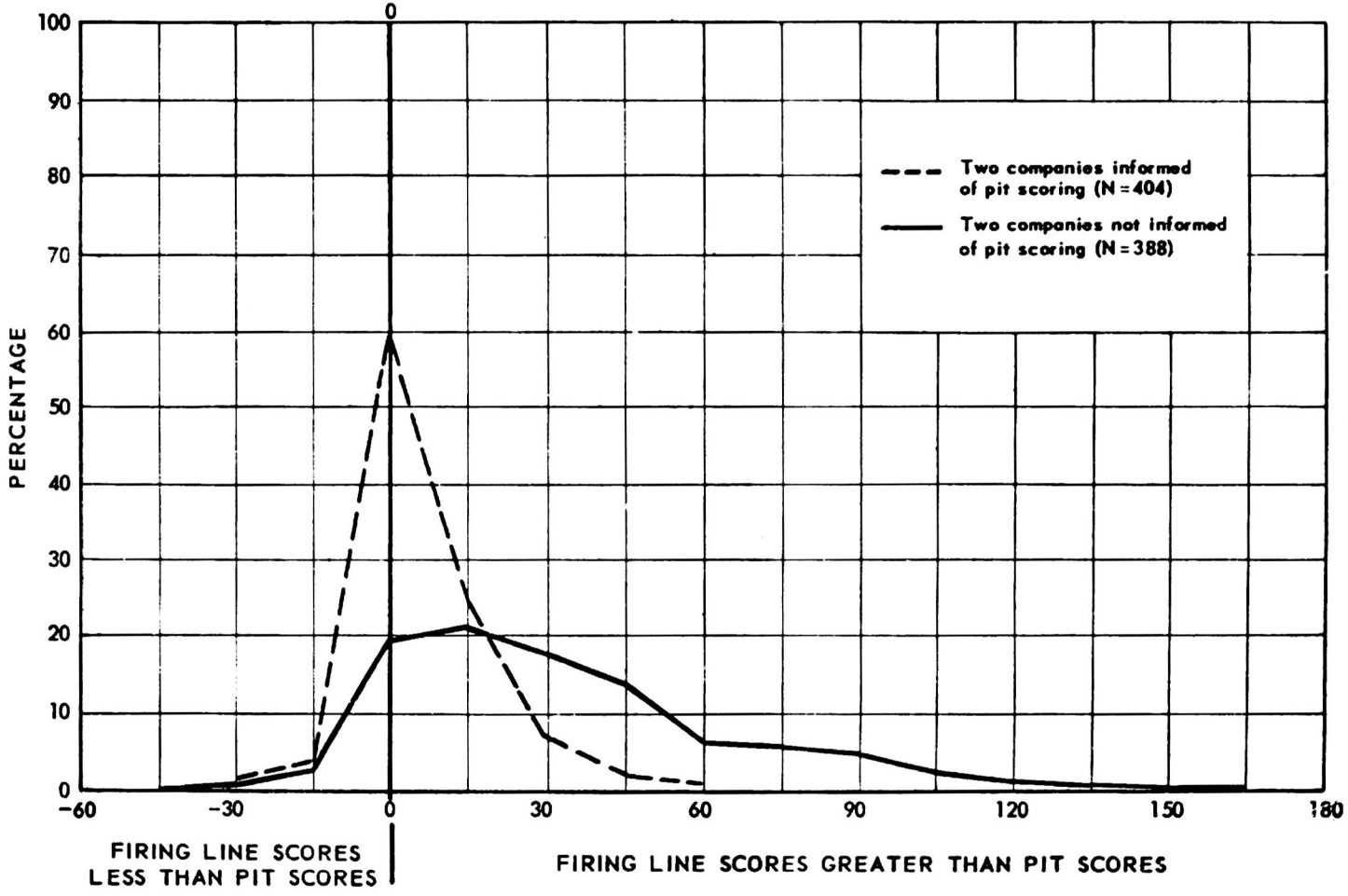

Figure 1

COMPARISON OF FIRING LINE AND PIT SCORES
IN M1 RIFLE TRAINING
(Informed and Uninformed Companies)

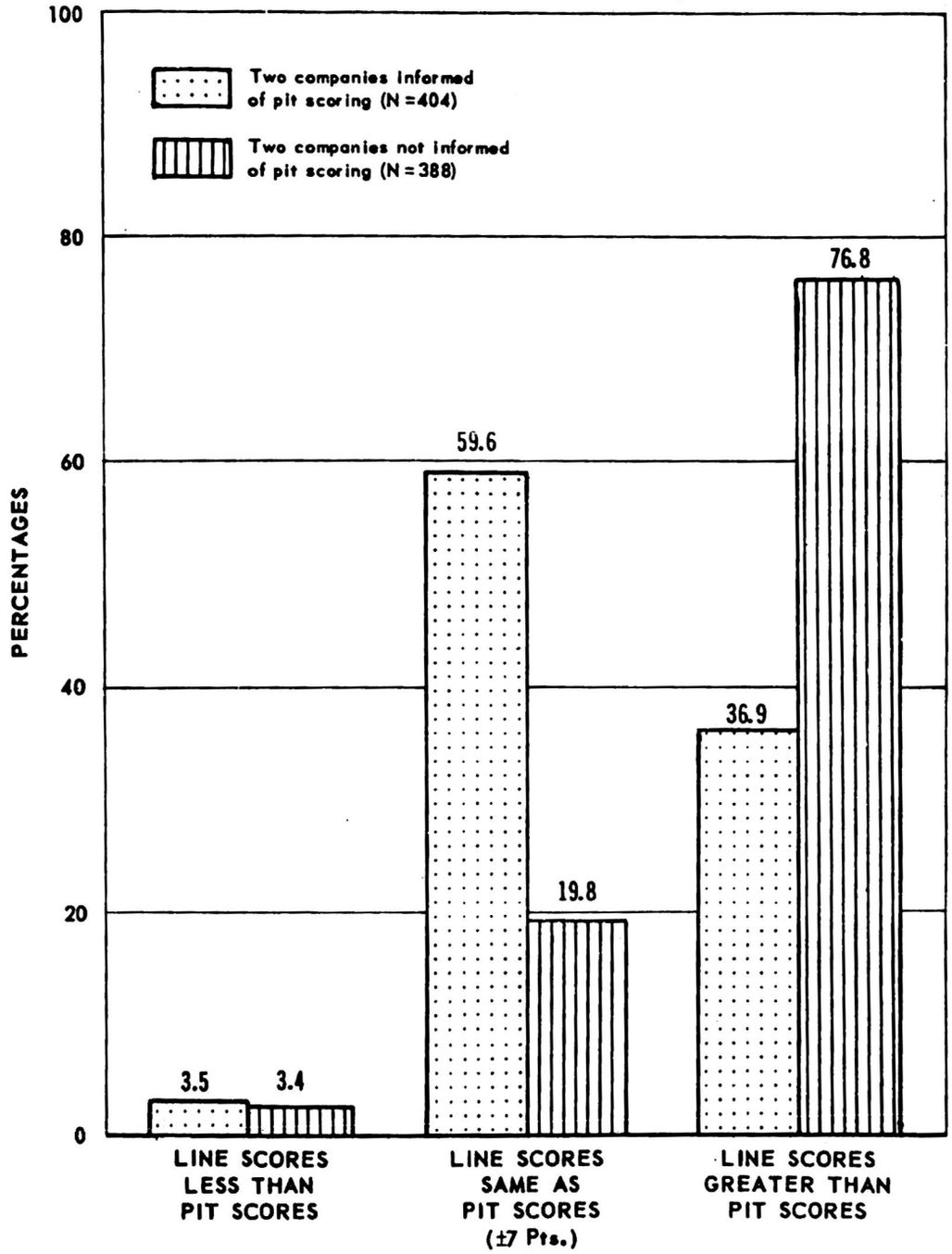

Figure 2

FREQUENCY DISTRIBUTION OF M1 RECORD FIRING SCORES AT ARMY INSTALLATION X

(As Scored in Pits)

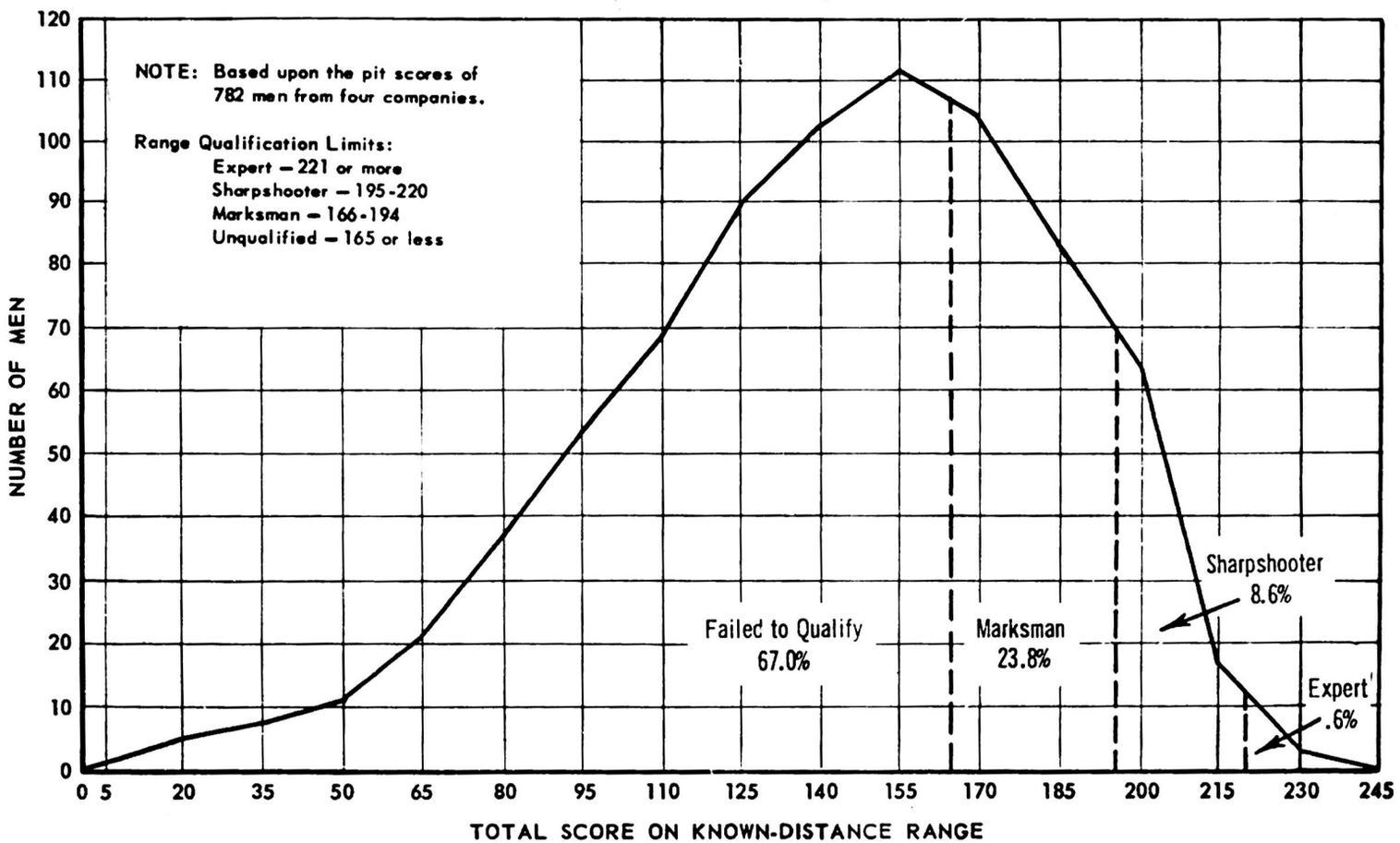

Figure 3

FREQUENCY DISTRIBUTION OF M1 RECORD FIRING SCORES AT ARMY INSTALLATION Y

(As Recorded in Pits)

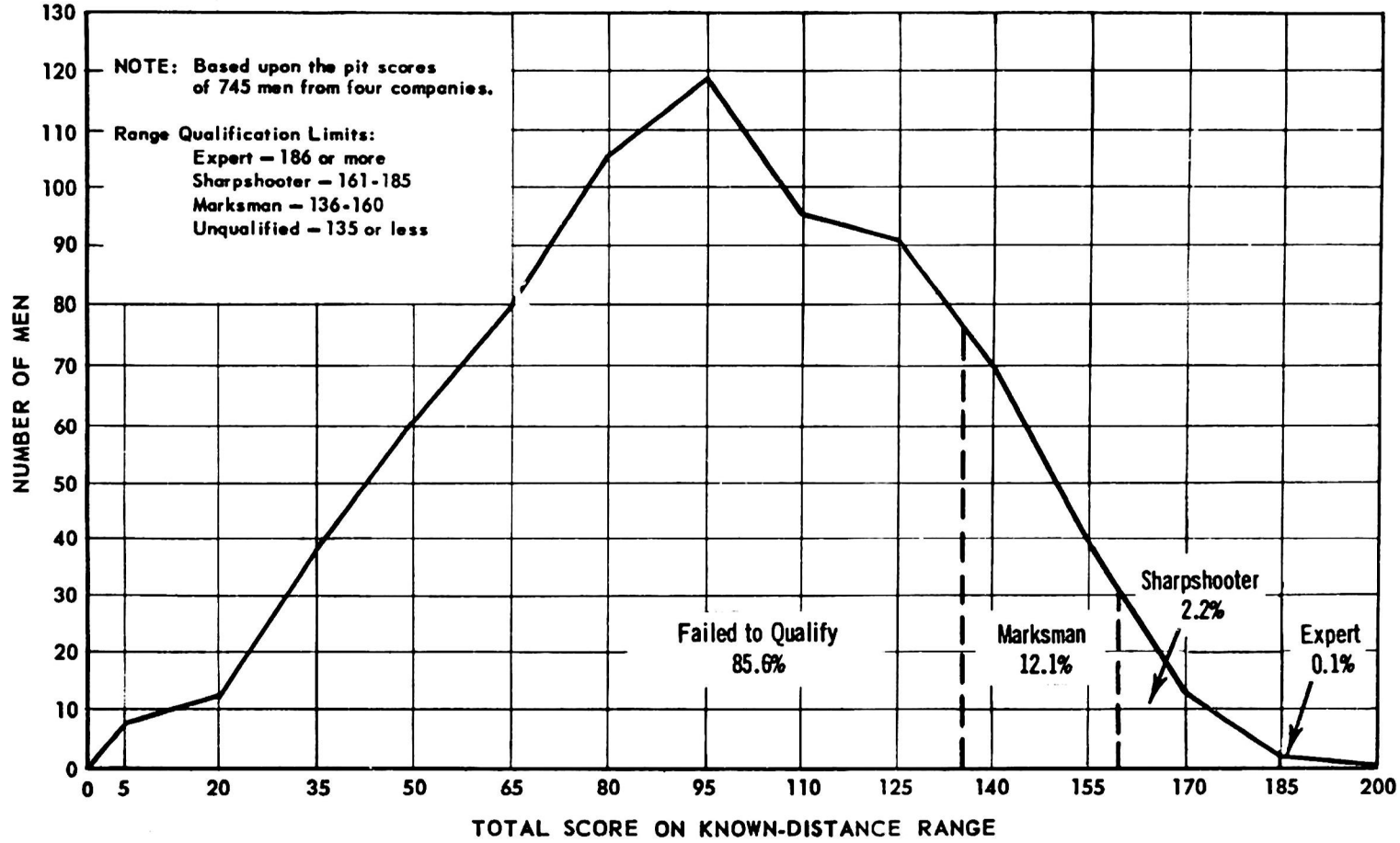

Figure 4

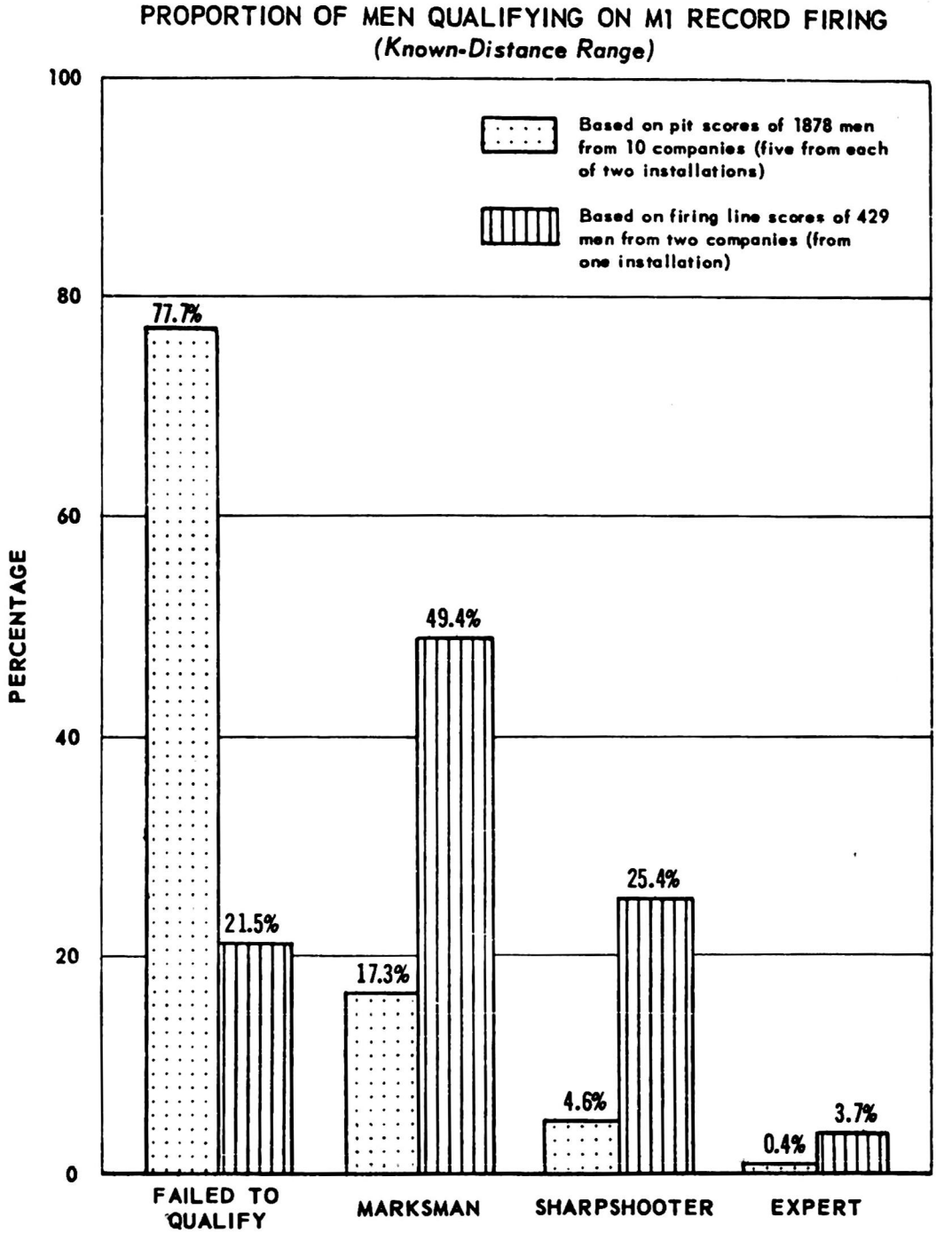
PROPORTION OF MEN QUALIFYING ON M1 RECORD FIRING
(Known-Distance Range)
Based on pit scores of 1878 men from 10 companies (five from each of two installations)
Based on firing line scores of 429 men from two companies (from one installation)
PERCENTAGE
100
80
60
40
20
0
77.7%
21.5%
17.3%
49.4%
4.6%
25.4%
0.4%
3.7%
FAILED TO QUALIFY
MARKSMAN
SHARPSHOOTER
EXPERT

Figure 5

Table 1

DISTRIBUTION OF DISCREPANCIES BETWEEN PIT AND LINE SCORES FOR M1 RECORD FIRING

(Informed and Uninformed Companies, Known-Distance Range)

Midpoint[a]	Two Companies Informed of Pit Scoring		Two Companies Not Informed of Pit Scoring	
	Number of Men	Per Cent	Number of Men	Per Cent
-45	0	-	1	.26
-30	3	.74	2	.51
-15	11	2.72	10	2.58
0	241	59.65	77	19.84
15	102	25.25	82	21.13
30	32	7.92	72	18.56
45	10	2.48	54	13.92
60	5	1.24	29	7.47
75	0	-	26	6.70
90	0	-	19	4.90
105	0	-	9	2.32
120	0	-	4	1.03
135	0	-	1	.26
150	0	-	1	.26
165	0	-	1	.26
Total	404	100.00	388	100.00

[a]Pit scores were subtracted from firing line scores, and these differences were grouped into intervals of 15 points. A minus score indicates a firing line score less than a pit score.